Mack T-11
D 7156 - EGR Engine Oil Test

Report Packet Version No.

Conducted For

	V =	**Valid; The reference oil/non-reference oil was evaluated in accordance with the test procedure.**
	I =	**Invalid; The reference oil/non-reference oil was not evaluated in accordance with the test procedure.**
	N =	**Results cannot be interpreted as representative of oil performance (non-reference oil) and shall not be used in determining an average test result using multiple test criteria.**

	NR = Non Reference Oil Test
	RO = Reference Oil Test

Stand:	**Stand Run:**	**Engine:**	**Engine Hours:**
End Of Test Date:		**End Of Test Time:**	
Oil Code:			
Formulation/Stand Code:			
Altcode1:	**Altcode2:**	**Altcode3:**	

In my opinion this test been conducted in a valid manner in accordance with the Test Method Dxxx and the appropriate amendments through the information letter system. The remarks included in this report describe the anomalies associated with this test.

Submitted By: _____

Testing Laboratory

_____

Signature

_____

Typed Name

_____

Title

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Form 2

Table of Contents

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Form 3
Summary of Test Method

The Mack T-11 EGR Engine oil Test is a fuel engine-dynamometer test which evaluates diesel engine oils for performance characteristics including viscosity increase and soot concentrations (loading). This test is a single-phase, steady state test (constant speed and load). The test is 252 hours and is run with retarded fuel injection timing to produce elevated soot levels in the oil.

The test engine is a Mack E-TECH V-MAC III diesel engine with EGR. It is an in-line six-cylinder, four stroke, turbocharged engine. It has electronically controlled fuel injection with six individual electronic pumps.

Mack T-11 Test Conditions

Parameter	Value
Time, h	252
Injection Timing, °BTDC	Variable
Speed, r/min	1800
Fuel Flow, kg/h	53.5
Intake CO_2, %	1.5
Exhaust CO_2, %	Record
Inlet Manifold Temp., °C	70
Coolant Out Temp., °C	66
Fuel In Temp., °C	40
Oil Gallery Temp., °C	88
Intake Air Temp., °C	25
Intake Air Restriction, kPa	3.5 – 4.0
Inlet Manifold Pressure, kPa	Tbd
Exhaust Back Pressure, kPa	2.7 – 3.5
Crankcase Pressure, kPa	0.25 – 0.75
Power, kW	Record
Torque, Nm	Record
Pre-Turbine Exhaust Temp., °C	Record
Tailpipe Exhaust Temp., °C	Record
Oil Sump Temp., °C	Record
EGR Pre-Venturi Temp., °C	Record
Inlet Air Dew Point, °C	Record
Fuel Pressure, kPa	Record
Main Gallery Oil Pressure, kPa	Record
Oil Filter Delta P, kPa	Not to exceed 138

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Form 4
Test Results Summary

Laboratory:	**EOT Date:**	**EOT Time:**
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Test Results		
Date Test Started:	**Start Time:**	
SAE Viscosity:	**Test Length:**	
TMC Oil Code:[A]	**Laboratory Oil Code:**	
TGA Soot % at 96 h		
TGA Soot % at 192 h		
TGA Soot % at 228 h		
TGA Soot % at 252 h		
Centrifugal Oil Filter Mass Gain, g		
Oil Filter Delta P, kPa		
EOT TBN		
Oil Consumption, g/hr		
Viscosity Increase at 6.0% Soot, cSt		
MRV Yield Stress, cP		
	Soot at 12 cSt (%)	**MRV (cP)**
Original Result		
Transformed Result		
Correction Factor		
Corrected Transformed Result		
Severity Adjustment		
Final Transformed Result		
Final Original Unit Result		

Last Stand Reference Results		
Test Number:		
Oil Code:		
Test Length:	**TMC Oil Code:**	
EOT Date:	**EOT Time:**	
Stand Calibration Expiration Date:		
TGA Soot % at 96 h		
TGA Soot % at 192h		
TGA Soot % at 228h		
TGA Soot % at 252 h		
Oil Consumption, g/hr		
Viscosity at 6.0% Soot, cSt		
	Soot at 12 cSt (%)	**MRV**
Final Original Unit Result		

[A] ***Reference Tests only.***

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Form 5
Operational Summary

Laboratory:	**EOT Date:**	**EOT Time:**
Test Number:		
Oil Code:		
Formulation/Stand Code:		

	Parameter	Units	QI Threshold	EOT QI [A]	Target	Average	Samples [B]	BQD [C]	Over/Under Range [D]
Controlled Parameters	Speed	r/min	0.000		1800				
	Fuel Flow	kg/h	0.000		53.5				
	Inlet Manifold Temp.	°C	0.000		70				
	Coolant Out Temp.	°C	0.000		66				
	Fuel In Temp.	°C	0.000		40				
	Oil Gallery Temp.	°C	0.000		88				
	Inlet Air Temp.	°C	0.000		25				
	Inlet Air Restriction	kPa			3.5 – 4.0				
	Inlet Man. Pressure	kPa			140 minimum				
	Exh. Back Pressure	kPa			2.7 – 3.5				
	Crankcase Pressure	kPa			0.25 – 0.75				
	Intake CO_2	%			1.5±.05				
Non-controlled Parameters	**Parameter**	**Units**	**Typical Values[E]**		**Average**				
	Power	kW	TBD						
	Torque	Nm	TBD						
	Exhaust CO_2	%	TBD						
	Pre-Turbine Temp. (F)	°C	TBD						
	Pre-Turbine Temp. (R)	°C	TBD						
	Tailpipe Temp.	°C	TBD						
	Oil Sump Temp.	°C	TBD						
	EGR Pre-Venturi Temp.	°C	TBD						
	Blowby	L/min	TBD						
	Inlet Air Dew Point	°C	TBD						
	Fuel Pressure	kPa	TBD						
	Main Gallery Oil Press.	kPa	TBD						

A QI values above the threshold are acceptable by the Mack Surveillance Panel. QI values below the threshold may not be considered acceptable based on an engineering review. Refer to Annex A3
B Total number of data points taken. Minimum acceptable value is 2520
C Number of Bad Quality Data points not used in the calculation of the statistical measures.
D Number of points clipped by over/under range limits.
E Typical values determined from reference oil test database

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Form 6
Oil Analysis Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Hours	Soot (Wt. %) D 5967 Annex 4	Viscosity at 100°C (cSt) D 5967 Annex A3	Viscosity Increase (cSt)	TBN D 4739	TAN D 664	Integrated IR Oxidation

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Form 7
Oil Analysis Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Hours	Shear Viscosity (cSt) D 6278 30 Pass	Shear Viscosity (cSt) 90 Pass	MRV Viscosity (cP) D 6896	Rotational Viscosity at 100°C (mPa-s)		Rotational Viscosity Rate Index	
				Increasing	Decreasing	Increasing	Decreasing
Rotational Viscosity of DIN 30 Pass Sample							
Rotational Viscosity of DIN 90 Pass Sample							

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Form 8
Oil Analysis Summary

Laboratory:	EOT Date:	EOT Time:
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Hours	Fuel Dilution D 3524	Metal Elements (ppm) D 5185							
		Fe	Pb	Cu	Cr	Al	Si	Sn	Na

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Form 9
Test Fuel Analysis (Last Batch)

Laboratory:	**EOT Date:**	**EOT Time:**
Test Number:		
Oil Code:		
Formulation/Stand Code:		
Supplier:	**Batch Identifiers:**	

Measurement	Specs.	Analysis		Test Method
		NEW	EOT	
Total Sulfur, % Weight	0.04 – 0.05			D 2622
Gravity, °API	34.5 – 36.5			D 287 or D 4052
Hydrocarbon Composition				
Aromatics % Vol.	28 – 33			D 1319
Olefin	Report			D 1319
Cetane Index	Report			D 976 & D 4737
Cetane No.	42 – 48			D 613
Copper Strip Corrosion	1 Maximum			D 130
Flash Point, °C	54 Minimum			D 93
Pour Point, °C	-18 Maximum			D 97
Carbon Residue on 10% Residuum, %	0.35 Maximum			D 524 (10% Bottoms)
Water & Sediment, % Vol.	0.05 Maximum			D 2709
Viscosity, cSt @ 40°C	2.4 – 5.0			D 445
Total Acid Number	0.05 Maximum			D 664
Strong Acid Number	0.00 Maximum			D 664
Accelerated Stability	tbd			D 2274
Distillation, °C				
IBP	Report			D 86
10%	Report			D 86
50%	Report			D 86
90%	282 – 338			D 86
EP	Report			D 86

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Form 10
Characteristics of the Data Acquisition System

Laboratory:	**EOT Date:**	**EOT Time:**
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Parameter (1)	Sensing Device (2)	Calibration Frequency (3)	Record Device (4)	Observation Frequency (5)	Record Frequency (6)	Log Frequency (7)	System Response (8)
Temperatures							
Oil @ Filt.							
Fuel In.							
Intake Air							
Intake Man.							
Pre-Turb.							
Cool. Out							
Other							
Fuel Flow							
Engine RPM							
Load							
Inlet Restr.							
Exh. Press.							
Oil Gal. Press.							

LEGEND:

(1) Operating Parameter

(2) The type of device used to measure temperature, pressure or flow

(3) Frequency at which the measurement system is calibrated

(4) The type of device where data is recorded
- **LG - Handlog Sheet**
- **DL - Automatic Data Logger**
- **SC - Strip Chart Recorder**
- **C/M - Computer, Using Manual Data Entry**
- **C/D - Computer, Using Direct I/O Entry**

(5) Data are observed but only if recorded off spec.

(6) Data are recorded but are not retained at EOT

(7) Data are logged as permanent record, note specify if:
- **SS - Snapshot Taken at Specified Frequency**
- **AG/X - Average of X Data Points at Specified Frequency**

(8) Time for the output to reach 63.2% of final value for step change at input

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Form 11
Build-up and Hardware Information

Laboratory:	EOT Date:	EOT Time:
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Injection Timing

Timing Hours	Timing (Deg)
	Total Timing Changes

Hardware

Part	Part Number	Serial Number
Primary Turbocharger		
Secondary Charger		
Cylinder Head (front)		
Cylinder Head (rear)		
Pistons		
Injection Nozzles		
Rod Bearings		
Liners		
Ring Set		

Cylinder Kit Location	CPD ID Number
Cylinder 1	
Cylinder 2	
Cylinder 3	
Cylinder 4	
Cylinder 5	
Cylinder 6	

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Form 12
Unscheduled Downtime and Maintenance Summary

Laboratory:	**EOT Date:**	**EOT Time:**
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Number of Downtime Occurrences				
Test Hours	**Date**	**Downtime**	**Reasons**	
			Total Downtime	

Other Comments

Number of Comment Lines		

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Form 12A
Unscheduled Downtime and Maintenance Summary

Laboratory:	**EOT Date:**	**EOT Time:**
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Number of Downtime Occurrences			
Test Hours	**Date**	**Downtime**	**Reasons**
			Total Downtime

Other Comments

Number of Comment Lines		

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Form 12B
Unscheduled Downtime and Maintenance Summary

Laboratory:	**EOT Date:**	**EOT Time:**
Test Number:		
Oil Code:		
Formulation/Stand Code:		

Number of Downtime Occurrences				
Test Hours	**Date**	**Downtime**	**Reasons**	
			Total Downtime	

Other Comments

Number of Comment Lines		